

M.Sc. Semester—I (C.B.C.S. Scheme) Examination

1-PHY-2 : PHYSICS

(Classical Mechanics)

Time : Three Hours]

[Maximum Marks : 80

- Note :—**(1) All questions are compulsory.
 (2) All questions carry equal marks.

EITHER

- i. (a) State and prove D'Alembert's principle. 8
- (b) State and prove the following conservation theorem for systems of particles :
 - (i) Angular momentum
 - (ii) Total energy. 8

OR

- (p) A block of mass 'm' slides down an inclined frictionless plane. Obtain its equation of motion using D'Alembert's principle. 8
- (q) State and prove the law of conservation of energy for a particle in conservative force field. 8

EITHER

2. (a) Obtain Lagrange's equation of motion from D'Alembert's principle for non-conservative system. 6
- (b) Obtain Lagrangian function for a particle moving on surface of sphere. 5
- (c) What do you mean by degrees of freedom ? Explain what is meant by configuration space. 5

OR

- (p) Set-up the Lagrangian for simple pendulum and hence obtain equation of motion. 6
- (q) Classify the different types of constraints with examples. 5
- (r) Define generalized co-ordinates. Enlist the advantages of generalized co-ordinates. 5

EITHER

3. (a) What is Legendre dual transformation ? Obtain Hamiltonian function from Lagrangian using Legendre dual transformation. 6
- (b) Compare the two formulation of mechanics, Lagrangian and Hamiltonian. 5
- (c) Explain Homogeneity of space and time, Isotropy of space. 5

OR

- (p) Obtain Hamilton-Jacobi's equation. 6
- (q) Find out Hamilton's function of motion of simple pendulum. 5
- (r) How conservation theorem for P, L and E are related to symmetry properties possessed by the System ? 5

EITHER

4. (a) State Kepler's 2nd law and justify that motion under Harmonic Central Force is always bounded. 6
- (b) Derive equation of motion under central force. What is first integral ? 5
- (c) If particles of a system attract each other according to inverse square law of force then prove that $2\bar{T} + \bar{V} = 0$, where $\bar{T}$ is average kinetic energy and $\bar{V}$ is average potential energy. 5

OR

- (p) How two body problem can be reduced to equivalent one body problem ? 6
- (q) State three Kepler's laws of planetary motion and derive kepler's First Law. 5
- (r) Show that the total energy of system is constant under the central force field. 5

EITHER

5. (a) Show that the transformation $q = \sqrt{2p} \sin Q$, $p = \sqrt{2p} \cos Q$ is canonical by using Poisson's bracket. 8
- (b) Explain how discrete system could be converted in continuous one. 8

OR

- (p) Show that the transformations $P = q \cot p$, $Q = \log \left(\frac{\sin p}{q} \right)$ are canonical. 8
- (q) Discuss the properties of Poisson brackets. What are Fundamental Poisson Brackets ? Prove that Poisson Brackets holds good the distributive law. 8